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## NEONTOLOGICAL EVALUATION OF PELVIC SKELETAL ATTRIBUTES PURPORTED TO REFLECT SEX IN EXTINCT NON-AVIAN ARCHOSAURS

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**ABSTRACT**—Sex in non-avian archosaurs has been inferred using a variety of osteological attributes. However, little quantitative data have been presented showing that these phenotypes truly exist. In this study, testing for the presence of pelvic osteological correlates of sex in extant archosaurs was conducted, using skeletons of wild-caught *A. mississippiensis* as a neontological model. For outgroup comparison, the squamate *Iguana iguana* is included. A sample of 16 females and 19 males of *A. mississippiensis*, and 18 females and 10 males of *I. iguana* were examined. Measurements included pelvic canal area, dorsoventral depth, and mediolateral width of the pelvic canal, mediolateral width between the dorsal edge of each ilium, and ischium orientation. These data were analyzed using analyses of covariance, a t-test, and a recently developed geodesic distance shape analysis. Results indicate that there is sexual dimorphism in the proportions of the pelvic canal in *A. mississippiensis*, with females typically having deeper pelvic canals than males. This dimorphism might be synapomorphic for Archosauria. No dimorphism was found in *I. iguana*. The detection of dimorphism in *A. mississippiensis* required large sample sizes owing to substantial overlap between sexes. Thus, sexing isolated specimens using this metric is tenuous at best. Assuming similar variance in the relative pelvic depth versus width in other non-avian archosaurs, this criterion would also produce imprecise determinations of sex for these taxa.

### INTRODUCTION

Determining sex in extinct archosaurs has become one of the most sought-after pursuits in vertebrate paleontology (Chapman et al., 1997). The reason for this interest is that sex determinations, combined with age information (Erickson et al., 2004), would facilitate studies of population demographics, an area for which little is known (Erickson et al., 2006). Moreover, it would aid in making taxonomic referrals, so that individuals of different sexes would not be mistaken as belonging to different taxa (Dodson, 1975). Alternatively, features that could be interpreted as sexually dimorphic may actually represent characters for species recognition, as suggested by Main and colleagues (2005) for the ornamentation of stegosaurs.

Sexual dimorphism in extant vertebrates often involves soft tissue structures that are wanting in fossil specimens. Beyond distinct ornamentation or color patterns (often unclear or unavailable in fossil taxa), most studies of sexual dimorphism in extant groups focus on external size and shape attributes. In squamate lizards (Diapsida), for example, the relative body size and proportions in varanid (Thompson and Withers, 1997) and agamid lizards (Shine et al., 1998), and python snakes (Shine et al., 1998) have been shown to be sexually dimorphic. Other studies have turned to the pelvic girdle because this area of the skeleton supports reproductive tissues that differ between sexes. Sexual dimorphism in the relative size of the pelvic canal has been shown in three species of testudines (Long and Rose, 1989),

with females having proportionately larger pelvic apertures. Additionally, within archosaurs, a study on California gulls (*Larus californicus*) revealed that males have wider cranial synsacra (Schnell et al., 1985). These examples suggest that osteological correlates could be used to determine sex in related fossil groups.

Within archosaurs, sexual determinations have been made using a variety of osteological criteria. These included the size and position of the cranial-most chevron in crocodylians (Romer, 1956) and non-avian theropods (Larson, 1994; refuted by Erickson et al., 2005); pelvic canal depth in the pterosaur *Pteranodon* sp. (Bennett, 1992); overall hip width (Larson, 2002) and ventral divergence of the ischium (Carpenter, 1990) in *Tyrannosaurus rex*; fusion of caudal vertebrae in sauropods (Rothschild and Berman, 1991); horn core length and curvature, and frill erectness in ceratopsians (Dodson, 1976; Lehman, 1990); crest size and shape in hadrosaurids (Dodson, 1975); relative robustness of cranial elements in troodontids, pachycephalosaurids, and tyrannosaurids (Brown and Schlaikjer, 1943; Chapman, 1990; Molnar, 1991; Larson, 1994); caniniform tooth proportions in heterodontosaurids (Thulborn, 1974), and robustness of femoral muscle attachment scars in the coelophysoid *Syntarsus rhodesiensis* (Colbert 1989; Raath, 1990); *T. rex* (Carpenter, 1990; Larson, 1994); and the prosauropods *Plateosaurus* sp. (Weishampel and Chapman, 1990) and *Thecodontosaurus antiquus* (Benton et al., 2000). However, the efficacy of these criteria remain to be proven: statistically supported osteological correlates definitively reflecting sex have not yet been presented in support of any of the previous criteria (Erickson et al., 2005) and neontological substantiation also has not occurred. In this study, we test for the presence of pelvic osteological correlates of sex in an extant

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archosaur as a model for dinosaurs and pterosaurs. We use the results to test the aforementioned hypotheses of Carpenter (1990), Bennett (1992), and Larson (1994) that purported sexually dimorphic osteological correlates in extinct archosaurs (see below).

Specifically, in a study of the variation in *T. rex*, Carpenter (1990) observed differences in the orientation of the ischial shaft relative to the horizontal articular surface of the iliac peduncle in three ischia. He found that one of the specimens' ischial shafts was ventrally divergent by a few degrees relative to the other two and suggested that it might correspond to a female. His argument was that this more divergent element would provide for a greater angle between the sacral vertebrae and the distal end of the ischium, which in turn would allow a more patent passageway for eggs. Although the ischia were standardized for length, no quantified degree value was reported. Furthermore, a neontological model for this hypothesis was not presented.

Larson and Frey (1992) and Larson (1994; 1998; 2002) explored a number of possible osteological correlates for us in sexing *T. rex*. Following qualitative assignment of specimens to robust and gracile morphotypes (for example, based upon the humerus and postorbital bones), Larson (2002) noted that the robust forms had relatively wider pelves. This observation led him to identify these robust morphs as females. Furthermore, to support his hypothesis he made neontological comparisons using birds and crocodilians. He further drew support for this hypothesis from neontological comparisons of birds and crocodilians. Larson (2002) observed that in some raptorial species, such as goshawks, the female pelvis is wider. Nevertheless, this observation lacked statistical support and the possibility that wider pelves simply correlate with larger size rather than with sex was not ruled out.

In crocodilians, the size and location of the first chevron has been regarded as indicative of sex, such that females have a relatively smaller first chevron, more caudally positioned than in males; hypothetically, this serves to increase the space available for the passage of eggs (Romer, 1956; Larson, 1994; 2002; Powell, 2000). Conversely, the first chevron would be longer in males for attachment of "penile retractor muscles" and located more cranially than in females. Larson (1994) reported on the finding of the same pattern in *T. rex*, where the robust morphotype happened to show the female chevron pattern of crocodilians and the gracile morphotype the male one. However, recently Erickson and colleagues (2005) have shown that there is no statistically significant difference between male and female crocodilians regarding the relative size and position of the first chevron, leaving little expectation in the efficacy of this criterion for predicting sex in theropod dinosaurs.

Bennett (1992) produced size-frequency histograms using measurements of several appendicular bones (including coracoids, humeri, radii, ulnae, metacarpals IV, wing phalanges, and tibiae) from hundreds of specimens of the pterosaur *Pteranodon* sp. He also used a G-test for testing the measurements of the distal condyles of metacarpal IV against unimodal and bimodal distributions. Most of the histograms showed that the specimens were bimodally distributed and representing two size classes. Likewise, each size class was characterized by a particular cranial crest and pelvic structure. Hence, he concluded that the taxon was dimorphic. Pelves from the purported larger morph had relatively shallower puboischiadic plates enclosing a smaller pelvic canal, while those of the smaller morph had deeper puboischiadic plates that enclosed a relatively larger pelvic canal. Additionally, Bennett (1992) pointed out that the morph with the larger pelvic canal had a deeper lateral emargination at the caudal end of the pelvic girdle. As a functional explanation for these differences, Bennett (1992) posited that the differences indicated primary sexual characteristics related to reproduction. The larger pelvic canal in the smaller morph would facilitate the pas-

sage of eggs. As with Carpenter's (1990) hypothesis, no neontological model in support of his speculations was advanced.

Here, we use the American alligator, *A. mississippiensis*, as archosaurian neontological model to test these hypotheses. This taxon is a qualified model as it is a representative of the extant non-avian clade Crocodylia, which is most closely related to dinosaurs and pterosaurs. To establish the phylogenetic polarity of these purported pelvic osteological correlates of sex and provide a preliminary insight of their distribution within Diapsida, we included in the analysis measurements from an archosaur outgroup, the squamate *Iguana iguana*.

**Institutional Abbreviations**—**FSUM**, Florida State University Museum, Tallahassee, Florida, U.S.A.; **ROM**, Royal Ontario Museum, Toronto, Canada; **FLMNH**, Florida Museum of Natural History, Gainesville, Florida, U.S.A.

## METHODS

Thirty-five wild *A. mississippiensis* were acquired from northern Florida (Gadsden, Seminole, and Jackson counties) through a state-licensed nuisance alligator control agent (Appendix 1). The sample included 16 females ranging from 152 to 264 cm in total length (TL) (70–145 cm in snout-vent length; SVL) and 19 males 152–335 cm in TL (70–124 cm in SVL). The sex of each specimen was determined through manual probing of the cloaca. The animals' axial regions, spanning from the sacral through the caudal proximal regions, were removed and placed in covered pits, where they were partially buried in sand. The soft substrate helped to keep all the bones articulated. For a period of 2 months, dermestid beetles consumed the adhering flesh. After exhumation, the specimens were accessioned into the collection of the Florida State University Museum, Tallahassee (FSUM).

For the outgroup comparison, 30 pelvic girdles of *Iguana iguana* were examined in the collections of the FLMNH and the ROM (Appendix 2). The FLMNH specimens were collected in southern Florida, primarily from Dade County (anonymous collectors), where the species has been introduced via the pet trade. Female size ranged from 36.4 to 110.5 cm in TL (13 to 35.5 cm in SVL) and male size from 41.2 to 122.3 cm in TL (15 to 44 cm in SVL). Sex and body measurements had been acquired by each institution upon accession.

Based on the parameters purported to reflect dimorphism in fossil archosaurs by Carpenter (1990), Bennett (1992), and Larson (1994; 2002), the following measurements were made on the pelvic girdle of the *A. mississippiensis* specimens to the nearest 0.01 mm. Depth of the pelvic canal was taken from the dorsal margin of the ischial symphysis to the mid-ventral centrum of the first sacral vertebra (Fig. 1B). Pelvic width was measured across the medial side of the articulation between each ilium and ischium (Fig. 1B). Pelvic canal area was measured digitally with Image J (Abramoff et al., 2004), a software that allows the measurement of the area from digital pictures (the program calculates the area using a manually traced contour of the pelvic canal, in this case in cranial view, and a set scale based on a graphic scale bar placed in the same optical plane as the pelvic canal.) The orientation of the ischium was measured as the angle between the dorsal margin of the iliac articulation surface and the long axis of the bone (Fig. 1C). Finally, the width of the pelvic girdle as a whole was measured across the most laterally salient point along the dorsal margin of each ilium (Fig. 1D).

For *I. iguana*, measurements of the pelvic canal were also made to the nearest 0.01 mm (Fig. 1A). The depth of the pelvic canal was measured from the ventral side of the first sacral centrum to the dorsal side of the ischial symphysis. The width of the canal was taken across the joint between each ischium and the first sacral rib. Finally, the area of the pelvic canal was computed digitally in cranial view using Image J (Abramoff et al., 2004). The orientation of the ischium was not measured because the

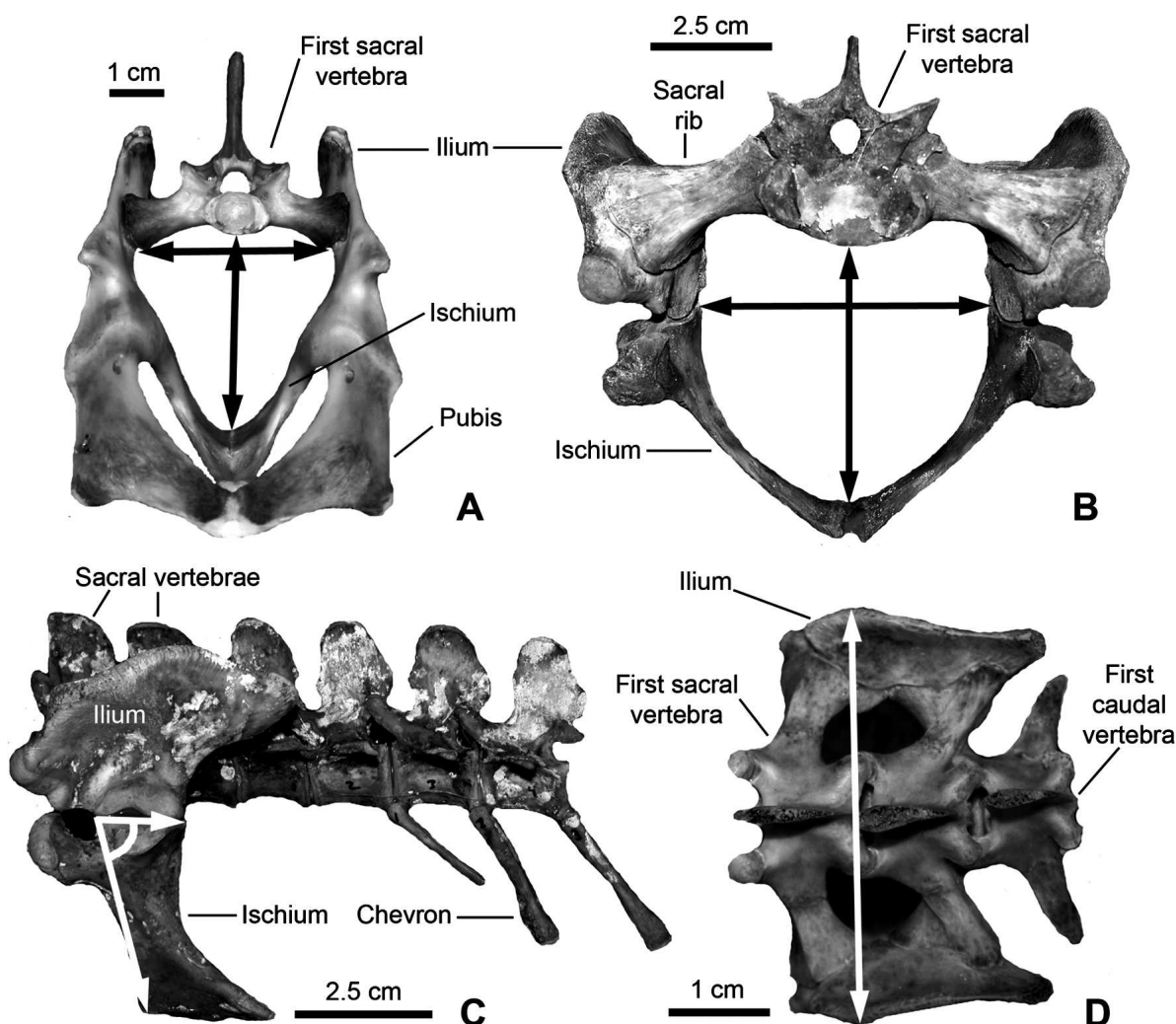


FIGURE 1. Measurements. **A**, pelvic girdle of *Iguana iguana*, FLMNH 135294, in cranial view, showing the pelvic canal with the measurements of width and depth indicated; **B**, pelvic girdle of *Alligator mississippiensis*, FSUM 5010, in cranial view, showing the pelvic canal with the measurements of width and depth indicated; **C**, pelvic girdle of *A. mississippiensis*, FSUM 5016, in left lateral view, showing how the inclination of the ischium was measured; **D**, pelvic girdle of *A. mississippiensis*, FLMNH 109040, in dorsal view, showing how the width between the ilia was measured.

disarticulated state of the material did not allow for a precise measure of this metric.

Both *A. mississippiensis* and *I. iguana* show size-related sexual dimorphism, in which males grow to larger sizes than females (Carothers, 1984; Wilkinson and Rhodes, 1997). Thus, to test for pelvic canal differences (i.e., those not related to overall body size) the data were analyzed using Analysis of Covariance (ANCOVA) in the R program (Ihaka and Gentleman, 1996). The data from *I. iguana* were log transformed, so that the residuals of the ANCOVA were normally distributed. For attributes not influenced by size (as in the depth-width ratio of the pelvic canal) a two sample T-test was performed to test for significant differences between the mean values in males versus females.

To statistically test for differences in pelvic canal shape, we implemented the geodesic distance shape analysis (GDA) recently developed by Klassen and colleagues (2004). Notably, this is the first time that GDA is applied to a biological system. In GDA, shapes (continuous curves) are represented as elements within an infinite-dimensional space. Our sample of shapes was obtained from manually tracing closed contours of the pelvic canals from digital images of the specimens, without the need for landmarks. Shape is a characteristic that is invariant to rigid

motions, uniform scaling, and the placement of origin (or starting point) on closed curves. Shape differences are then computed by finding geodesics (or shortest length paths) intrinsic to the shape space. We used GDA to calculate the mean shape for male and female pelvic canals separately in *A. mississippiensis* and *I. iguana*. These means were compared to reveal where shape differences were anatomically localized. We standardized this comparison by taking the ventral margin of the first sacral centrum as reference.

## RESULTS

In *A. mississippiensis*, hip width across the ilia (ANCOVA:  $F = 0.56$ ,  $P = 0.461$ ), ischial inclination (ANCOVA:  $F = 1.44$ ,  $P = 0.239$ ), and area of the pelvic canal (ANCOVA:  $F = 0.69$ ,  $P = 0.412$ ) showed no significant difference between males and females (Fig. 2A, B, and F) at a  $P$  value of .05. Females showed slightly deeper (ANCOVA:  $F = 3.81$ ,  $P = 0.056$ ) and males slightly wider ( $F = 5.08$ ,  $P = 0.031$ ) pelvic canals (Fig. 2C, D), although only the second difference was statistically significant at a  $P$  value of .05. The ratio between the depth and width of the pelvic canal ( $P < .001$  in the two-sample T test) (Fig. 2E) was statistically significant at a  $P$  value of .05.

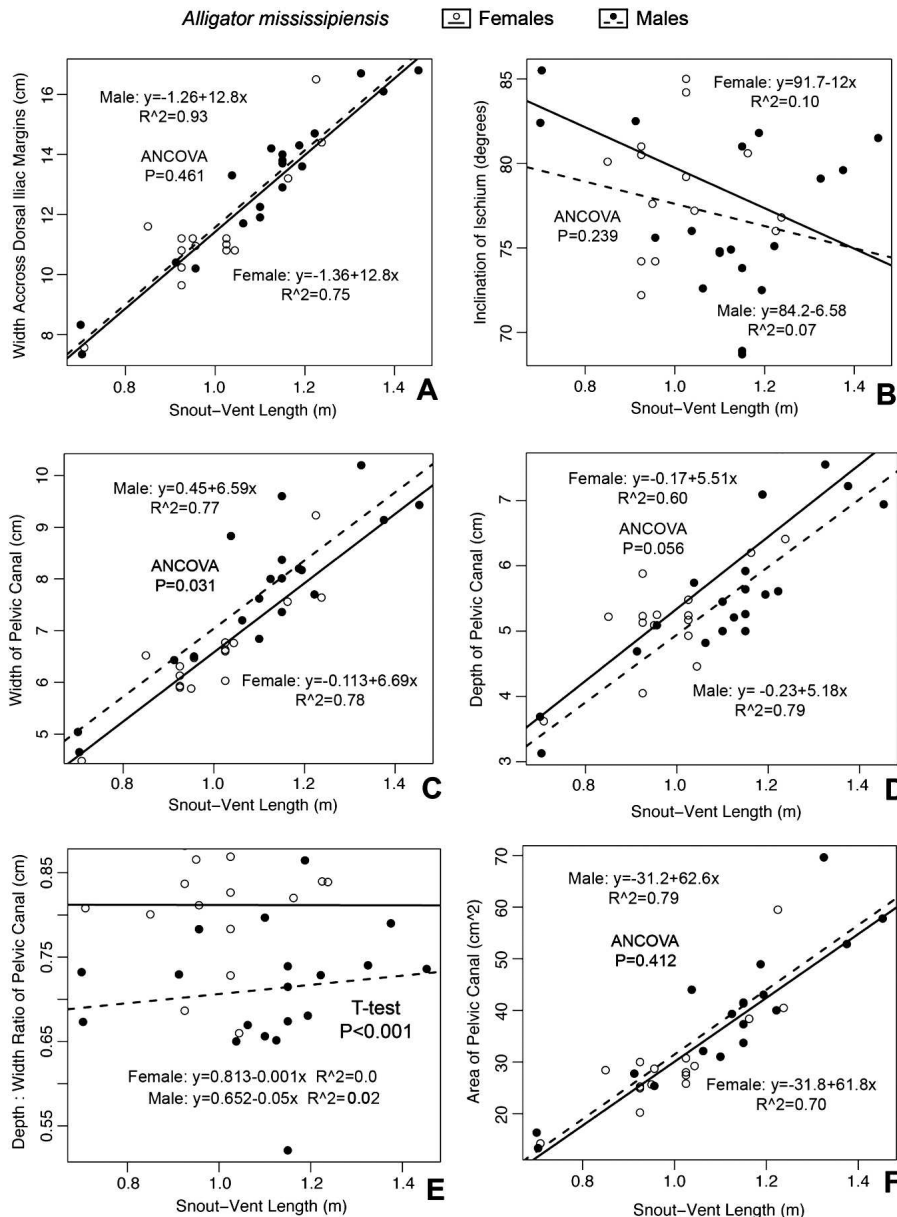


FIGURE 2. Bivariate scatter plots of the studied measurements in *Alligator mississippiensis*. **A**, Relationship between the pelvic width across the dorsal margin of each ilium and snout-vent length; **B**, relationship between the inclination of the ischium and snout-vent length; **C**, bivariate plot showing the relationship between width of the pelvic canal and snout-vent length in the sample of males and females; **D**, relationship between depth of the pelvic canal and snout-vent length in the sample of males and females; **E**, relationship between the depth/width ratio of the pelvic canal and snout-vent length in the sample of males and females; **F**, relationship between the area of the pelvic canal and snout-vent length in the sample of males and females.

Comparison of the mean shape of the pelvic canal of male and female *A. mississippiensis* from the GDA revealed that the slight increase in width in the male profile is localized dorsolaterally, along the ventral margin of the sacral ribs and where they articulate with each ilium (Fig. 3). The relative increase in depth of the female profile of the pelvic canal is found in the ventral region, where both ischia arch medioventrally to meet at the sagittal plane (Fig. 3).

Finally, we found that the linear dimensions and area of the pelvic canal in *I. iguana* were statistically indistinguishable between sexes at a  $P$  value of .05 (Fig. 4). Width of the pelvic canal was not significantly different between sexes at a  $P$  value of .05 (ANCOVA:  $F = 0.25$ ,  $P = 0.623$ ). Depth and area of the pelvic canal did not differ significantly between sexes at a  $P$  value of .05 (ANCOVA:  $F = 0.01$ ,  $P = 0.991$ , ANCOVA:  $F = 0.03$ ,  $P = 0.867$ , respectively).

#### DISCUSSION AND CONCLUSION

As a means to identify sex in fossil archosaurs, this study tested for sexual dimorphism in the pelvic girdle of a member of the

only living outgroup to pterosaurs and dinosaurs that has a closed pelvic canal. We also included in the analysis a member of Lepidosauria as a second outgroup to those fossil archosaurs (see Fig. 5) to polarize several pelvic attributes purported to reflect

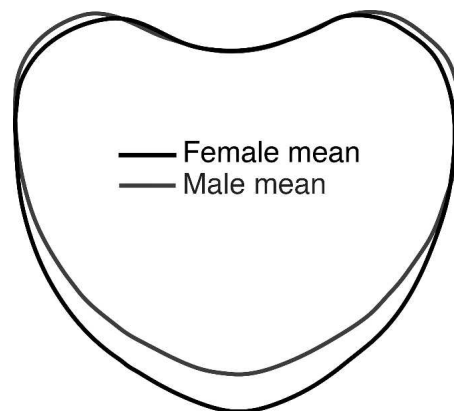


FIGURE 3. Superimposition of the male mean profile and the female mean profile of the pelvic canal using geodesic shape analysis.

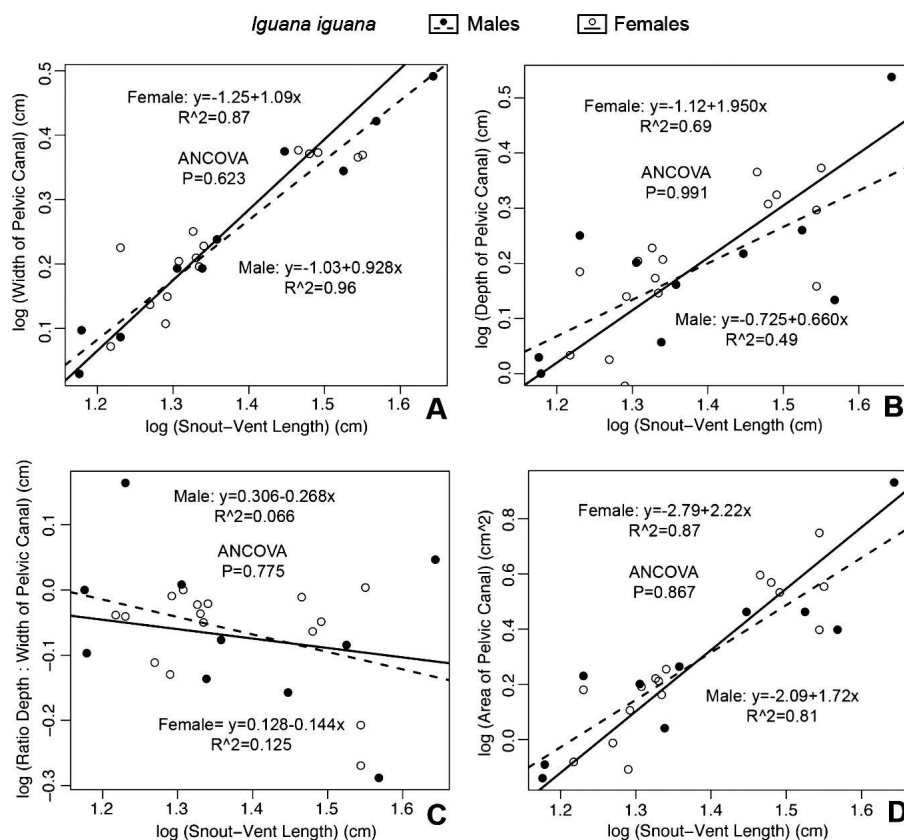


FIGURE 4. Bivariate scatter plots of the studied measurements in *Iguana iguana*. **A**, relationship between width of the pelvic canal and snout-vent length in the sample of males and females; **B**, relationship between depth of the pelvic canal and snout-vent length in the sample of males and females; **C**, relationship between the depth/width ratio of the pelvic canal and snout-vent length in the sample of males and females; **D**, relationship between the area of the pelvic canal and snout-vent length in the sample of males and females.

sex. In this context, we were able to evaluate the neontological support for several hypotheses of sexual dimorphism in fossil archosaurs in a phylogenetic framework. As indicated by our lepidosaur and archosaur models, Carpenter's (1990) hypothesis regarding ischial shafts being more ventrally divergent in female *T. rex* is not supported. Additionally, Larson's (2002) hypothesis positing mediolaterally wider hips across the ilia in female *T. rex* is not supported on the same grounds (Fig. 2A).

In contrast, we identified a weak dimorphic signal in pelvic canal width that might be synapomorphic for Archosauria (Fig. 5): males have relatively wider pelvic canals than females (Fig. 2C). This dimorphism being synapomorphic for archosaurs is only a tentative conclusion because its presence has yet to be documented in dinosaurs, and it is ambiguous whether it was present in the common ancestor of these and *Pteranodon* (Fig. 5). Thus, whether this dimorphism was shared or lost within dinosaurs is a potential subject for further research. However, the depth-width ratio being significantly different in males and females of *A. mississippiensis* (Fig. 2E) does provide statistical neontological support for Bennett's (1992) hypothesis that there was a dimorphism in the pelvic canals of *Pteranodon*. Though weakly so, we can be sure that this dimorphism, in the case of *A. mississippiensis*, is sex-specific. Due to Bennett's (1992) small number of *Pteranodon* pelvises analyzed and the weak signal garnered from *A. mississippiensis*, support for the sex-specific nature of this dimorphism in *Pteranodon* is positive, although it remains meager at this time.

The large overlap of variation in the depth-width ratio of the pelvic canal in the male and female samples of *A. mississippiensis* points to the potential for incorrect sexual discriminations for individuals of unknown sex. The overlap between the two samples only allows for a 60% chance of accurately predicting the sex of a single individual. In the fossil record sample size is often restricted to a few specimens. Assuming a similar degree of sex overlap, the presence of this dimorphism would be statisti-

cally difficult to prove, and, more importantly, it would lack a practical application in most instances should similar overlap be shown.

This study continues the search for osteological correlates of sex in fossil archosaurs by focusing on the pelvic girdle of living forms. Although it did not address the functional implications of pelvic canal differences between sexes in *A. mississippiensis*, such an endeavor would be appropriate for future research. Moreover, the present study highlights the need for further studies quantifying the characters herein used and/or new ones on more species of both extant and fossil crocodylians, as well as on pterosaurs and dinosaurs for which large enough sample sizes exist. Unless sexual dimorphism can be directly observed in fossils (e.g., pachypleurosaurs, as in Sander, 1988; 1989; or the finding of gravid females reported by Cheng and colleagues in 2004), our

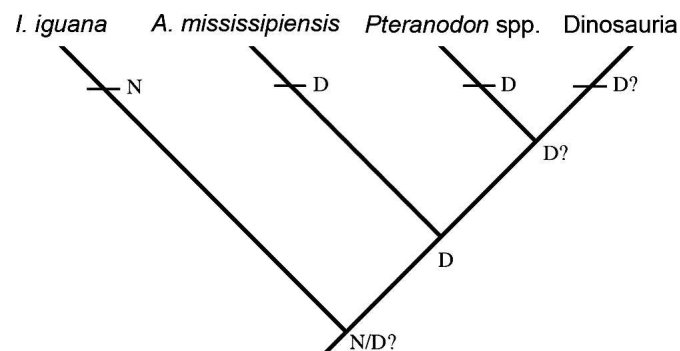


FIGURE 5. Cladogram of the diapsid taxa, showing the distribution of pelvic sexual dimorphism. N = lack of sexual dimorphism in the pelvic girdle; D = presence of sexual dimorphism in the relative depth of the pelvic canal. Cladogram based on Liem and colleagues (2001).

study identifies the need for neontological models to be well established before they can be informative in predicting attributes of fossil specimens.

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APPENDIX 1. Sex, size, and pelvic measurements for *Alligator mississippiensis*.

Specimen #	Sex	Snout–vent length (m)	Pelvic canal width (cm)	Pelvic canal depth (cm)	Depth:width ratio	Pelvic canal area (cm <sup>2</sup> )	Width across ilia (cm)	Ischial inclination (°)
FSUM 5006	Male	1.10	7.62	5.00	0.66	31.01	11.90	74.7
FSUM 5010	Male	1.19	8.20	7.09	0.87	48.93	14.30	81.8
FSUM 5011	Male	1.13	8.00	5.21	0.65	39.32	14.20	74.9
FSUM 5015	Male	1.15	9.60	5.00	0.52	41.34	14.00	68.7
FSUM 5004	Male	0.96	6.50	5.09	0.78	25.36	10.20	75.6
FSUM 5009	Male	1.19	8.17	5.56	0.68	43.03	13.60	72.5
FSUM 5005	Male	1.06	7.20	4.82	0.67	32.12	11.70	72.6
FSUM 5000	Male	0.70	4.65	3.13	0.67	13.32	7.34	85.5
FSUM 5001	Male	0.70	5.04	3.69	0.73	16.33	8.32	82.4
FSUM 5014	Male	1.04	8.83	5.74	0.65	44.00	13.30	76.0
FSUM 5013	Male	1.15	8.01	5.92	0.74	41.52	13.70	81.0
FSUM 5007	Male	1.10	6.84	5.45	0.80	31.05	12.25	74.8
FSUM 5012	Male	1.15	8.37	5.64	0.67	37.32	13.80	73.8
FSUM 5008	Male	1.15	7.36	5.26	0.72	33.70	12.90	68.9
FSUM 5003	Male	0.91	6.43	4.69	0.73	27.76	10.40	82.5
FSUM 5018	Male	1.45	9.43	6.94	0.74	57.78	16.80	81.5
FSUM 5016	Male	1.22	7.70	5.61	0.73	40.00	14.70	75.1
FSUM 5020	Male	1.33	10.20	7.55	0.74	69.63	16.70	79.1
FSUM 5017	Male	1.38	9.14	7.22	0.79	52.84	16.10	79.6
FSUM 5034	Female	1.24	7.64	6.41	0.84	40.48	14.40	76.8
FSUM 5029	Female	1.02	6.31	5.88	0.93	30.00	11.20	80.5
FSUM 5022	Female	0.93	5.90	4.05	0.69	20.21	9.64*	72.2
FSUM 5019	Female	0.71	4.48	3.62	0.81	14.23	7.56	91.0
FSUM 5028	Female	1.03	6.03	5.24	0.87	25.81	10.80	86.9
FSUM 5030	Female	1.02	6.60	5.17	0.78	28.00	11.20	79.2
FSUM 5025	Female	0.95	5.88	5.09	0.87	25.64	11.20	77.6
FSUM 5032	Female	1.03	6.77	4.93	0.73	27.45	10.80	84.2
FSUM 5023	Female	0.96	6.47	5.25	0.81	28.70	10.95	74.2
FSUM 5033	Female	1.16	7.56	6.20	0.82	38.36	13.20	80.6
FSUM 5024	Female	0.93	6.13	5.13	0.84	24.92	10.80	74.2
FSUM 5031	Female	1.04	6.76	4.46	0.66	29.23	10.80	77.2
FSUM 5026	Female	1.03	6.63	5.48	0.83	30.74	11.00	85.0
FSUM 5021	Female	0.93	5.93	5.23	0.88	25.23	10.23	81.0
FSUM 5027	Female	0.85	6.52	5.22	0.80	28.42	11.60	80.1
FSUM 5035	Female	1.23	9.23	7.75	0.84	59.49	16.50	76.0

APPENDIX 2. Sex, size, and pelvic measurements for *Iguana iguana*.

Specimen #	Sex	Snout–vent length (cm)	Pelvic canal width (cm)	Pelvic canal depth (cm)	Depth:width ratio	Pelvic canal area (cm <sup>2</sup> )
ROM R4652	Male	28.0	2.37	1.65	0.70	2.90
ROM R4653	Male	17.0	1.22	1.78	1.46	1.70
ROM R4655	Male	15.0	1.07	1.07	1.00	0.73
ROM R6022	Male	21.8	1.56	1.14	0.73	1.10
ROM R7078	Male	37.0	2.64	1.36	0.52	2.50
FLMNH 56873	Male	33.5	2.21	1.82	0.82	2.90
FLMNH 141610	Male	20.2	1.56	1.59	1.02	1.59
FLMNH 142641	Male	15.1	1.25	1.00	0.80	0.81
FLMNH 142644	Male	22.8	1.73	1.45	0.84	1.84
FLMNH 143608	Male	44.0	3.10	3.45	1.11	8.53
ROM R2720	Female	35.0	3.68	1.98	0.54	5.60
ROM R4651	Female	16.5	1.18	1.08	0.92	0.83
ROM R4654	Female	17.0	1.68	1.53	0.91	1.52
ROM R5842	Female	13.0	0.86	0.62	0.72	0.33
ROM R7086	Female	35.0	2.32	1.44	0.62	2.50
FLMNH 141041	Female	18.6	1.37	1.06	0.78	0.97
FLMNH 141488	Female	21.6	1.57	1.40	0.89	1.45
FLMNH 141614	Female	31.0	2.36	2.11	0.89	3.41
FLMNH 141767	Female	14.0	0.93	0.91	0.98	0.54
FLMNH 142317	Female	30.2	2.35	2.03	0.86	3.71
FLMNH 142595	Female	21.4	1.62	1.49	0.92	1.63
FLMNH 142642	Female	20.3	1.60	1.60	1.00	1.55
FLMNH 142595	Female	21.4	1.62	1.49	0.92	1.63
FLMNH 142642	Female	20.3	1.60	1.60	1.00	1.55
FLMNH 142643	Female	21.2	1.78	1.69	0.95	1.66
FLMNH 142650	Female	19.6	1.41	1.38	0.98	1.28
FLMNH 142652	Female	21.9	1.69	1.61	0.95	1.80
FLMNH 142656	Female	29.2	2.38	2.32	0.98	3.94
FLMNH 142673	Female	19.5	1.28	0.95	0.74	0.78
FLMNH 142724	Female	35.5	2.34	2.36	1.01	3.58